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ABOUT SHELLS.

BY CHARLES WRIGHT.



IN the course of my herborizations in Cuba, I have had frequent occasion to climb trees for flowers which I could not otherwise obtain, and much more frequent occasion to clamber about the limestone cliffs which furnish a great variety of plants, many of which are common in such localities, and are found nowhere else. In these circumstances, it was hardly possible that my attention should not be drawn to the shells, some inhabiting trees, and many more the rocks. I came, in truth, to be very fond of them, spending many hours entirely devoted to shell hunting, which, I begin to think, I could have spent more profitably in my legitimate calling. I propose to relate some of my observations, and to give my views as to the causes of some of the phenomena observed, hoping that they who make this branch of the animal kingdom a special study, may be prompted to investigate these phenomena more minutely than I had time or ability to do.

Shells have a season of hibernation in hot climates as well as in cold; but, in the former, the cause of their inactivity is dryness; in the latter, low temperature. If the drought be protracted, the greater part seek a retreat where

some degree of moisture prevails; for example, in the ground or among the dead leaves covering it; in a hollow tree or in the crevices of the bark; under stones or among the leaves of epiphitic Tillandsias. But occasionally an individual is found abroad at this season, and repeated examination led me to discover *a* reason for it; whether it is *the* reason, may remain for wiser ones to determine. These shells are commonly stuck fast where they are found, or glued as it were, and not merely adhering as in a time of rest in the wet season. And they have all been injured,—the shell more or less broken. Are they going to die? Are they undergoing repairs? This last seemed to me more probable. They *are* always, in part at least, grown together, not quite symmetrically often, but generally quite firmly. Do they eat by night as in the rainy season? This I cannot assert. The firmness of their attachment would indicate that they do not. So uniform has been my experience in this case, that now, if I see an Achatina, or a large Helicina, on a tree in the dry season, however inviting they may appear at a distance, I pass them by as worthless.

Oleacina and its allies are carnivorous snails. They have a smooth polished delicate shell, yet possess the power to capture and devour others many times larger than themselves, besides being protected by a firm shell, and with a closely fitting hard operculum. Not unfrequently we find large shells like *Helicina regina*, or *H. sagraæana*, quietly submitting to be devoured by an Oleacina, which it has the strength to walk off with, as easily as a tortoise could carry away a mouse. Wherein lies their great strength? I can offer a suggestion. I have often been in such situations on the face of a vertical cliff, that I needed both hands for support. At such times, if a shell attracted my attention, I used to put it between my lips till I reached a place where both hands were free. Thus I learned, that the watery or slimy secretion which all these animals emit, in the case of this group, is bitter; and in the larger species, very deci-

dedly so. I can hardly doubt that the secret of the power which these snails possess is to be sought here. May not this bitterness produce a benumbing effect on their prey? I have discovered a like bitterness in no other shell, and I have collected many species in this way, using my mouth as a temporary box.

Proserpina has a shell of like delicate structure as that of Oleacina. Once I found one in close contact with a Melaniella. This, together with its structure, led me to suspect that it, too, is carnivorous. Who knows? Will an examination of the tongue tell? Will some one try it? I once amused myself capsizing these little fellows, and if they did not manifest real anger, there was a very good imitation of it. Turned on its back, it lashed its tail about violently for a snail; or I might say it behaved mulishly and kicked,—the organ thus forcibly used being called the foot, I believe. The inverted position seemed a painful or disagreeable one.

I hesitate to record an observation repeatedly made on account of the apparent improbability of the fact, and the difficulty of explaining it. Individuals of some species of shells many times vary greatly in size as well as in color. In other species, the said variations are slight. In one or more species of Cyclostoma of this latter kind, I have often found young individuals considerably larger than any fully grown. There could be no shadow of a doubt that these were all of the same species, and not two distinct ones living together. Among a dozen or two fully formed shells and others nearly grown, all agreeing well in size, one, perhaps two or more, incomplete individuals would occur, so much larger than all the rest, as to suggest the question,—*Why do we not find finished shells of this larger size?*

Two solutions of this question have presented themselves as possible, though neither of them is quite satisfactory. One is, that the animal has power to absorb its shell and reconstruct it of a smaller size. The other, which seems more probable, is, that these overgrown individuals are abnor-

mal, deformed, and never come to perfection. Thus, being thin and fragile, they soon crumble and disappear. I have thought that I found proof or evidence that mollusks *have* power to absorb and reform the shell. From *Melania* and *Paludina*, which are viviparous, I used to preserve the young found in the process of cleaning the shells. Observing that they were quite blunt at the apex, and that somehow in their growth toward maturity they became sharp-pointed, I could in no other way account for this than by supposing that they absorbed the shell, and reconstructed it after a smaller pattern. I will admit, for what it is worth, the possibility of inaccuracy in my observations when comparing small things with great. Thus, a very short cone might appear blunt, while, if increased tenfold, the bluntness would be, relatively, quite little. Yet this view does not satisfy me, and I still think my first impressions were correct. Will not some one by accurate measurements settle this question?

On the beach to the eastward of Matanzas the habits of a *Cyclostoma* struck me as noteworthy. A hundred yards or more from the shore, the ridge formed of sand and broken shells is overgrown with various trees and bushes, which this shell ascends probably to feed on some lichen. But if the tree leaned at any considerable angle, say twenty-five or thirty degrees, no shell could be found on it. And of the bushes, too, it had its choice as to size, also. None seemed to venture up a bush, or there was no attraction for them, if it were not larger than the finger or thumb. It may very well be, that on the small bushes they found nothing to eat; but the same reason cannot be given for their refusal to ascend larger leaning ones.

It has been said above, that in winter shells mostly lie dormant, not on account of the cold, but of the dryness. But if, at this season, a heavy shower occurs, which is not very unusual, they come out of their hiding places and appear to be feeding; not, indeed, in such numbers as during the summer, for already many are dead. Now, let a

norther, which is a drying wind, spring up, and they haste away to their retreats with all possible speed. Such a shower occurred on a winter night when I was in the neighborhood of Guane, where there are excellent rocks for shells, and many and various shells among the rocks. Early in the morning I found some specimens of *Melaniella Pichardi*. They were not abundant, though I saved a considerable number, and was desirous of collecting more of them, as it is, by no means, common. While I was at breakfast, a light norther began blowing. I made but little stay, and returned to the rocks, in hopes, though not confident, of finding more. Not one was to be seen, however. Similar effects are produced by a norther on other shells. Just at night I have observed *Cyclostoma salebrosum*, in numbers, on rocks, where, in the morning, if a norther prevailed during the night, not one could be found but by searching among the leaves at the base of the rocks. This shell, with some others, as *Cycl. rotundatum* and *Cycl. undatum*, have a way of letting go and rolling to the bottom of the rock if it be inclined (and they seem to prefer such), when they see the hand approaching; and this, apparently, when they have not even *one* eye open. It would seem as if they felt the approach of danger.

A group of Cyclostomas, *C. claudicans* Poey, *C. assimile* Gundl., *C. tenebrosum* Mor., and perhaps others, spin a thread by which they hang from the lower side of projecting rocks. When the weather clears after a rain, numbers may be found thus at rest, particularly in the early summer, when the young abound. Whether they can haul in their line I am unable to say, but guess they cannot; for many are found with the border broken, which could hardly be so common, unless caused by a fall from some height. If in this position they fall, it must sometimes be a distance of fifty, or, it may be hundreds of feet. These are all thin, delicate shells; and the power of suspension seems as if designed for their injury or destruction.

*Helix stigmatica*, and its allies, live under stones or among dead leaves. They are dull in color, and the most of them small in size. *H. stigmatica* is never found fairly in the daylight. Once only, if I rightly remember, I found an individual which had just turned the corner of the rock under which it lived. Why do they not come out to the light, and what do they live upon in their dark retreats? Another group, of similar habits, comprises *Helix Titanica*, *H. pulcherrima* and others. These have longitudinal lines of bristles, or rather stiff hairs, which are quite conspicuous in the young shell, but diminish, wear away, or quite disappear with age.

Shells often cease growing for a time, so far at least as relates to their calcareous covering. Their growth is interrupted during the dry season, and it may also be by an unusually dry time in summer. In banded shells, when the growth is resumed, the pattern of their markings is often, perhaps always, changed. The bands may be moved to the right or left, or be divided into two, or two may be united, or a color may be suppressed, or a new one introduced, or any one color may be widened or narrowed. In *Helix picta* Born., the variety of markings is almost innumerable. While the animal remained quiescent as a whole, why did not the several parts retain their relative positions? The color-secreting glands must have changed in position.

The wide diffusion of some species, and the extremely limited area in which others are found, excite in the inquiring mind a desire to know the causes of this unequal distribution. *Helix regina* in several forms is found in the whole of the mountain range of the western part of the island. *Helicina adspersa* is another extensively diffused species, besides being very variable in size and markings. On the other hand, *Cyclostoma foveatum* has been found only in one locality, at the base of a high projecting cliff, in considerable numbers, but all dead; nor is it known where it lives. I have looked upwards from below, and have climbed to the top and looked downwards in vain. Not more than two or

three have been obtained in a moribund state,—a single one only with sufficient life to enable Gundlach to describe and figure the animal. A few square yards contain all we know of this species. *Achatina fasciata* is found from one end of the island to the other, and at all elevations above the sea, under several forms which have been described as distinct species. *Helix picta* Born. is another widely diffused shell, and extremely variable in color and size. I have observed many young in the top branches of a high tree just felled, on the very top of the mountains, in Yateras. It seems to be a high climber, which may account for its comparative rarity, fully grown and alive. I have met with very few.

*Cylindrella* is largely represented in Cuba, more than eighty species being enumerated in the latest catalogue. Most of the species are extremely local; several, so far as is now known, being restricted to localities of a few yards square, or to a few rods. Doubtless other localities will be discovered for many of them. A few, as *C. Poeyana*, *C. elegans* and *C. irrorata*, are much more widely spread, but probably not one extends through the whole island as does *Achatina fasciata*. But what is most noteworthy is the remarkable tenacity of life possessed by many species. Some have lived for months, and even years; and, unless closely confined, they will crawl forth on the return of warm, damp spells of weather, getting into the wrong boxes and creating sad confusion.

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## THE SMALLER FUNGI.

BY JOHN L. RUSSELL.

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[Concluded from page 570.]

ANOTHER point of interest worthy the attention of the observer, and furnishing subject matter for the microscope, is a sort of dimorphism,\* and even something like alternate generations such as is observed in the lower animals. We

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\* *Dimorphism*, two shapes or forms.